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EXAMINER	
CULBERT, ROBERTS P	

ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 11/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/807,537	SHEKEL ET AL.	
	Examiner	Art Unit	
	Roberts Culbert	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 September 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) *1-13* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *14-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 9/21/06 have been fully considered but they are not persuasive to overcome the rejections of the previous Office Action.

Regarding Claim 14, applicant has argued that Shen et al. fails to teach that an etch rate is provided. However, Shen et al. provides the amount of photoresist material removed (concentration) in real time (Col. 4, Lines 9-29) which provides the etch rate as broadly recited in the claims.

Regarding Claim 15, applicant has argued that the infared spectral range disclosed by Shen et al. differs from the near infrared range disclosed in the instant application. However the argument is not clear since Claim 15 does not mention the near infrared range.

Regarding Claim 16, applicant has argued that Shen et al. utilize only the "level of intensity" of the detected radiation (Column 2, lines 46-49) and do not perform a chemometric manipulation. However, the argument is unpersuasive since Shen et al. teach manipulation using a conventional programmable logic controller. (Col. 4, lines 30-48)

Regarding Claim 18, applicant has argued that Shen et al. do not teach that the algorithm provides a rate of depletion of a chemical component. However, Shen et al. teach a rate of depletion of the resist materials in the acidic stripper solution, for example.

Regarding Claims 22-24, applicant has argued that Shen et al. do not teach that the comparing step comprises converting one optical property into a concentration rate of change of at least one chemical component. However, Shen et al. teach converting one optical property (light intensity) into a concentration rate of change of at least one chemical component (photoresist or acid stripping solution)

Regarding Claim 26, applicant has argued that Shen et al. do not teach detecting a fault in a rate of addition of a replenishing component. Applicant further argues that Column 4, lines 38-44 describe use of a detected optical signal to indicate the need for corrective action to remove accumulated photoresist

materials (not to replenish a component). The argument is unpersuasive since the removal of accumulated material replenishes the solution component as broadly recited in the claimed invention.

Regarding Claim 28, applicant has argued that Shen et al. do not teach a method that is independent of temperature and the presence of bubbles. However, applicant provides no support or reasoning for the argument. Shen indicates no bubble formation and measures light intensity independent of temperature.

Regarding Claim 32, applicant has argued that Shen et al. do not teach determining a concentration of an acid. However, Shen et al. teach determining a concentration of the stripper acid.

Regarding Claim 33, applicant has argued that Shen et al. teach use of an infared light source (2000 - 15,000 nm wavelength), but do not teach use of the near infrared light source (700 - 2500 nm wavelength) used for the instant invention. However, the argument is not persuasive because Shen et al. teaches that the light source is an infared light source (Col. 4, lines 1-6), which includes near infared light sources less than 2500nm.

Applicant has argued that Brause et al. actually teach away from the instant invention by stating that the silicon oxide "*etch rate depends on HF acid concentration*" (page 24, second column, second paragraph, lines 5-6) and "*methods available today...include near infrared (NIR) spectroscopy*" and have "*major drawback...that they are used only on a 'stand-alone' basis and frequently are quite expensive. Compact instrumentation and full integration of these techniques into the process baths have had limited success"*

The argument is not persuasive. In fact, Brause expressly teaches that for NIR spectroscopy is one of several available methods for continuous monitoring of wet process solutions. The fact that "compact instrumentation" and "full integration" have had only limited success certainly does not teach away from using NIR as a monitoring technique for wet processing.

Applicant has argued that although "*ambiguities in the equilibrium constants and concentration estimates were observed*" (page 34,ncolumn 2, last paragraph), Thompson et al. stated "*The*

measurement scheme presented in this paper should be adaptable for process measurements" (page 35, first column, second paragraph). However, they provided no suggestion concerning the type of adaptation that would be required, and the use of the word "*should*" indicates doubt by the authors that such an adaptation could be made. That this doubt was very significant is indicated by the statement by Thompson et al. "*Our results appear consistent with the commonly accepted model for HF dissociation. However,... the intensities of the reconstructed spectra depend on the concentration range studied. This is yet another manifestation of the ill-posed nature of this analysis, which is only partially alleviated by model-based regression.*" This statement definitely teaches away from use of NIR for controlling HF etchant solutions. This is particularly true considering that Thompson et al. performed an academic study under well-defined conditions, and did not investigate real-world etchant solutions, which are dynamic and often contain interfering by-product species.

The argument is not persuasive. The suggestion that "the use of the word "*should*" indicates doubt by the authors that such an adaptation could be made" is unsupported. In fact, the use of the word "*should*" indicates reasonable certainty by the authors that such an adaptation could be made. Thompson et al. teaches (Conclusion) that the measurement technique "*can be sucessfully applied to the simultaneous measurement of HF, F-, HF_2-, H^+, and OH- over broad ranges of concentration and pH.*"

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 14-16, 18, 21-24, 26, 28, 32 and 33 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 6,203,659 to Shen.

Regarding Claim 14, Shen et al. teach a method for real-time dynamic analysis of chemical etching of a solid in a liquid etchant, comprising the steps of: passing electromagnetic radiation from an

electromagnetic radiation source (22) through a liquid etchant (stripper), at least at two points in time, wherein said liquid etchant is operative to etch said solid; performing *ex situ* non-contact scanning detection over a predetermined spectral range (infared) of said electromagnetic radiation passed through said liquid etchant, by means of a detector (24) over said at least at two points in time so as to detect at least one change in an at least one optical property of said liquid etchant; comparing said at least one change in said at least one optical property at said at least two points in time by means of an algorithm in a processor (26) so as to provide a rate of etching of said solid.

Regarding Claim 15, Shen et al. teach passing includes: emitting electromagnetic radiation in a predetermined spectral range from an electromagnetic radiation source, transmitting said electromagnetic radiation via a first optical transmission element from said electromagnetic radiation source through a sampling element containing a sample of said liquid etchant, and conveying output electromagnetic radiation from said sample of said liquid etchant via a second optical transmission element to said detector.

Regarding Claim 16, Shen et al. teach that comparing further comprises performing a chemometric manipulation on data relating to at least one change in said at least one optical property to provide the stripper concentration level.

Regarding Claim 18, Shen et al. teach that the algorithm further provides a rate of depletion of at least one chemical component of said liquid etchant over a period of time.

Regarding Claim 21, Shen et al. teaches that passing the liquid etchant through a sampling element having a substantially transparent sampling tube. (C3, L55-65)

Regarding Claim 22-24, Shen et al. teach that the comparing step comprises converting one optical property change into a concentration rate of change of at least one chemical component of the liquid etchant.

Regarding Claim 26, Shen et al. teach detecting a fault in a rate of addition of a replenishing chemical component. (C4, L38-48)

Regarding Claim 28, the method is independent of temperature and the presence of bubbles as claimed by applicant.

Regarding Claim 32, Shen et al. teach determining a concentration of an acid.

Regarding Claim 33, Shen teach an infared light source. (C4, L1-8)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 14-26, 28 and 30-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over the publication "*In-Situ Chemical Concentration Control for Wafer Wet Cleaning*" to Brause et al. in view of The publication "*Quantification of Hydrofluoric Acid Species by Chemical Modeling Regression of Near-Infrared Spectra*" to Thompson et al.

Regarding Claim 14, the publication "In-Situ Chemical Concentration Control for Wafer Wet Cleaning" to Brause et al. teaches that the etching of SiO_2 depends strongly on temperature and HF concentration. (P 315, bottom paragraph) Brause et al. further teach that the etch rate of the SiO_2 may be accurately controlled by controlling HF concentration in the etching process. However, Brause et al. teach measuring conductivity to determine the concentration of HF in the etching process. Brause et al. do not teach optical detection techniques.

However, the publication "Quantification of Hydrofluoric Acid Species by Chemical Modeling Regression of Near-Infrared Spectra" to Thompson et al. teaches that electromagnetic radiation spectroscopy may be used to measure the concentration of HF in aqueous solution. Brause et al. further teach passing electromagnetic radiation from an electromagnetic radiation source through a liquid etchant (hydrofluoric acid), at least at two points in time, wherein said liquid etchant is operative to etch said solid; performing *ex situ* non-contact scanning detection over a predetermined spectral range (infared) of said electromagnetic radiation passed through said liquid etchant, by means of a detector (24) over said at least at two points in time so as to detect at least one change in an at least one optical property of said liquid etchant; comparing said at least one change in said at least one optical property at said at least two points in time by means of an algorithm in a processor (26) so as to provide a concentration of the etchant.

It would have been obvious to one of ordinary skill in the art at the time of invention to use NIR measurement to measure HF concentration in the method of Brause et al. since Thompson et al. teach that the NIR technique is particularly well suited to quantification of HF over wide concentration and pH ranges such as in etching baths.

Regarding Claim 15, Thompson et al. teach that passing includes emitting electromagnetic radiation in a predetermined spectral range from an electromagnetic radiation source, transmitting said electromagnetic radiation via a first optical transmission element from said electromagnetic radiation source through a sampling element containing a sample of said liquid etchant, and conveying output electromagnetic radiation from said sample of said liquid etchant via a second optical transmission element to said detector.

Regarding Claim 16, Thompson et al. teach that comparing further comprises performing a chemometric manipulation on data relating to at least one change in said at least one optical property to provide the stripper concentration level.

Regarding Claims 17 and 19, Since Thompson teaches using the algorithm to determine concentration from the spectra data, and Brause teach that the etch rate correlates with concentration, it would have been obvious to one of ordinary skill in the art at the time of invention to determine the

differential rate of change of etching using data for the change in concentration, a processor algorithm being an obvious expedient to one of ordinary skill in the art.

Regarding Claim 18, Thompson et al. teach that the algorithm further provides a rate of depletion of at least one chemical component of said liquid etchant over a period of time.

Regarding Claim 20, Brause et al teach a liquid etchant comprising ions halide ions (HF).

Regarding Claim 21, Thompson et al. teaches that passing the liquid etchant through a sampling element having a substantially transparent sampling tube.

Regarding Claim 22-24, Thompson et al. teach that the comparing step comprises converting one optical property change into a concentration rate of change of at least one chemical component of the liquid etchant.

Regarding Claim 25, the process limitations merely recite conventional steps for forming a calibration model from known reference data, well known in the art of data analysis using a spectrophotometer. Note that Brause et al. teach that oxide thickness measurements may be used to determine etch rates, and Thompson et al. teaches that a calibration model may be developed using a regression method and spectrum data aquired from samples irradiated with NIR.

Regarding Claim 26, Thompson et al. teach detecting a fault in a rate of addition of a replenishing chemical component.

Regarding Claims 28, the claim recites a confidence level that is inherently met by the prior art measuring procedures and instruments or else arises from essential limitations not provided for in the claims.

Regarding Claim 30, the method is independent of temperature.

Regarding Claim 32, Thompson et al. teach determining a concentration of an acid.

Regarding Claim 33, Thompson et al. teach a near-infared (NIR) light source.

Claims 27 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over The publication "In-Situ Chemical Concentration Control for Wafer Wet Cleaning" to Brause et al. in view of The publication "Quantification of Hydrofluoric Acid Species by Chemical Modeling

Regression of Near-Infrared Spectra" to Thompson et al. and in further view of JP 63307334 A to Nogami.

Regarding Claims 27 and 29, Brause et al. in view of Thompson et al. teaches the method of the invention substantially as claimed but does not expressly teach detecting bubbles.

However the step is old and well known in the art of making measurements with a spectrophotometer.

For example, JP 63307334 A to Nogami teaches a method of making a detection process independent of air bubbles. It would have been obvious to one of ordinary skill in the art at the time of invention to use a spectrophotometer superior in sensitivity in order to prevent irregularity in the sample data in the well-known manner.

Regarding Claims 28, the claim recite a confidence level (95%) that is an inherent result of the prior art measuring procedures and instruments or else arises from essential limitations not provided for in the claims, since there are no recited manipulative differences.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Roberts Culbert whose telephone number is (571) 272-1433. The examiner can normally be reached on Monday-Friday (8:30-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

R. Culbert
Examiner
Art Unit 1763

Parviz Hassanzadeh
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